

REMARKS

Applicants have added new claims 53 to 61. Applicants have cancelled the non-elected claims due to the Examiner's restriction requirement. Claims 7-23, 50-52, and new claims 53-61 are pending in this application.

Support for claim 60 can be found at page 4, third full paragraph, and page 10, second and third paragraphs, and page 11, last full paragraph.

Support for claim 61 can be found at page 4, second full paragraph,

Support for claim 62 can be found at page 4, second full paragraph,

Claims 7-14, 19 and 21-23 are rejected under 35 U.S.C. 102(e) as being anticipated by Streinz, U.S. Patent No. 5,993,686.

With respect to independent claim 7: Applicants respectfully traverse. Claim 7 teaches a slurry having two oxidizers that exhibits a synergistically increased metal removal rate. Streinz describes "a chemical mechanical polishing slurry comprising an abrasive, an oxidizing agent, and a fluoride containing additive." *See* Streinz, column 3, lines 20-23. Streinz subsequently discloses a "laundry list" reciting essentially every known oxidizer, and merely adds "and mixtures thereof" at the end of the "laundry list" of oxidizers, as quoted below.

Suitable oxidizing agents are those that are compatible with fluoride containing additives including oxidizing metal salts, oxidizing metal complexes, nonmetallic oxidizing acids such as peracetic and periodic acids, iron salts such as nitrates, sulfates, EDTA, citrates, potassium ferricyanide, hydrogen peroxide, potassium dichromate, potassium iodate, potassium bromate, vanadium trioxide and the like, aluminum salts, sodium salts, potassium salts, ammonium salts, quaternary ammonium salts, phosphonium salts, or other cationic salts of peroxides, chlorates, perchlorates, nitrates, permanganates, persulfates and mixtures thereof. *See* Streinz, column 3, line 59 to column 4, line 4. There is no teaching of any synergistic combination of oxidizers in Streinz, as required by claim 7.

Applicants further contend that Streinz did not accidentally anticipate the claims, because at the time the application was filed that one of ordinary skill in the art would not consider a fluoride-containing compound such as hydrogen fluoride or ammonium bifluoride to be an "oxidizer" as the term was used in the context of chemical mechanical polishing slurries.

Streinz teaches a combination of an oxidizer and a fluoride-containing additive, but Streinz does not consider the fluoride-containing additive to be an oxidizer. This is shown in the description of the invention quoted above, and is consistent with the description of oxidizers quoted above that did not include fluoride-containing species. Streinz teaches “the fluoride component of the fluoride containing additive causes titanium to form a hydrated oxide layer that is more easily abraded than the oxide layer formed in the absence of fluoride.” *See* Streinz, column 4, lines 18-23. Streinz teaches that the concentration of oxidizers is 0.5% to 15%, preferably 1% to 7% (*see* Streinz, column 4, lines 8-13) while the fluoride-containing additive concentration is 0.01% to 2%, preferably 0.01% to 1% (*see* Streinz, column 4, line 61 to column 5, line 5). *See also* Streinz, column 3, lines 1-4; column 5, lines 25-29; column 8, lines 24-29; column 8, lines 53-56; and claim 1 for further text showing Streinz did not intend that the fluoride-containing agent is an oxidizer. As one of ordinary skill in the art does not consider fluoride to be an oxidizer, Streinz did not accidentally anticipate claim 7.

Streinz does teach that, to his slurry having an oxidizer and a fluoride-containing additive, that an inorganic acid or salt thereof can be included to enhance the polishing rate. *See* Streinz, column 7, lines 19-26. It has long been known in the art that polishing rates are pH dependent, and also that polishing rates can increase if salts are added to the slurry. However, the inorganic acids and salts thereof are not oxidizers, and adding a salt to a composition comprising an oxidizer generally does not form first and second oxidizers that are different from one another. We note that hydroxylamine salts can be different oxidizers than hydroxylamine, because the salts are so tightly bound to the hydroxylamine that the oxidizing potential of the salt is markedly different than the oxidizing potential of hydroxylamine. As an indicator of its reactivity, while hydroxylamine can not be purchased nor safely handled unless it is diluted with an equal weight of water, hydroxylamine salts are routinely available as solids and/or 85% solutions. However, hydroxylamine is a special case, and to form the hydroxylamine salts it is necessary to go above pH 11 (for the phosphate) and this is a higher pH than is used by those of skill in the art. Additionally, Streinz does not disclose hydroxylamine.

Claim 7 recites “a polishing slurry comprising a first oxidizer and a second oxidizer, wherein the second oxidizer is different than the first oxidizer, and the slurry comprising the first and second oxidizers exhibits a synergistically increased substrate removal rate.” As was the case for Streinz, Applicants did not and do not intend for fluoride-containing species to be

included in the term “oxidizer.” The broadest concept of the invention was a polishing slurry comprising an oxidizing agent, as recited in the first paragraph under the Summary Of The Invention (on page 7 in the original specification). Representative oxidizers are repeatedly recited in the specification. *See* for example the second through the fifth paragraphs under the Summary Of The Invention (on pages 7 to 8 in the original specification) reciting hydroxylamine, ammonium persulfate, a compound which is an indirect source of hydrogen peroxide, peracetic acid, and periodic acid, respectively.

The application does not state that a fluoride-containing compound is an oxidizer. The application mentions using ammonium bifluoride in the context of oxide polishing. *See* paragraph bridging page 14 and 15. Oxide polishing, which means polishing an oxide layer such as silica (*see* page 14, first full paragraph), is distinguished from metal polishing wherein the polishing is enhanced by an oxidizer reacting with the metal to form a layer of metal oxide which is then removed (*see* page 3, last two paragraphs). In the context of oxide polishing, the application discusses why it is advantageous to not have an oxidizing slurry. *See* page 15, first and second full paragraphs). It is therefore clear that Applicants did not intend a fluoride-containing compound to be classified as an oxidizer, either in the specification itself nor in claim 7, and Applicants specifically disclaim any fluoride as being an oxidizer as the term is used in claim 7 *et seq.* While Applicants believe those of ordinary skill in the art when the application was filed would not consider a fluoride-containing compound to be an oxidizer, the Applicants would be amenable to any amendment the Examiner may propose be included in claim 7 to this effect.

Streinz teaches using an oxidizer with a fluoride-containing additive. Streinz does not teach any combination of first and second oxidizers that provide a synergistic metal removal rate. There is no mention of synergy using any combinations of oxidizers in Streinz. There is no examples in Streinz that use a plurality of oxidizers, nor any teaching as to what combinations may be beneficial. The term “and mixtures thereof” ending Streinz’s list of essentially all oxidizers does not anticipate Applicant’s claimed invention that certain combinations of oxidizers when used together in a slurry “exhibits a synergistically increased metal removal rate.” Applicant’s respectfully request that this rejection to independent claim 7 and to claims 8-23 depending therefrom be reconsidered and removed.

With respect to dependent claim 10: Applicants respectfully traverse. The discussion of Streinz as it relates to claim 7 is incorporated herein by reference. Claim 10 teaches a slurry having an abrasive, wherein “the slurry further comprises a polyelectrolyte in an amount sufficient to encourage the abrasive particles to repel the surface to be polished.”

Streinz describes the use of compounds to “stabilize a polishing slurry containing an oxidizing agent against settling, flocculation and decomposition of the oxidizing agent” that include “surfactants, polymeric stabilizers or other surface active dispersing agents,” and that “the addition of a surfactant may be useful to improve the within-wafer-non-uniformity (WIWNU) of the wafers,” wherein “the amount of an additive used, such as a surfactant, in the present invention should be sufficient to achieve effective stearic stabilization of the slurry and will typically vary depending on the particular surfactant selected and the nature of the surface of the metal oxide abrasive.” *See* Streinz, column 7, line 54 to column 8, line 4. This disclosure of Streinz may encompass the recitation of dependent claim 9, which recites a polyelectrolyte being present in an amount such that articles repel one another, to reduce the problems resulting from agglomeration of abrasive particles. The Streinz disclosure does not teach or suggest, however, incorporating an amount of polyelectrolyte such that the particles are repelled from the substrate surface as recited in claim 10. Applicant’s respectfully request that this rejection to dependent claim 10 be reconsidered and removed.

With respect to dependent claim 11: Applicants respectfully traverse. Applicants disclose a peroxymonosulfate compound. This is Caro’s acid or salt thereof, commonly written as H_2SO_5 . See the specification, page 18, second full paragraph. The Examiner is apparently equating this with a potassium salt of sulfuric acid, H_2SO_4 . Much like the distinction between hydroxylamine and ammonia described below, these compounds have completely different properties, where the extra oxygen in the molecule imparts an oxidizing activity not present in the compound of similar formula but not having the extra oxygen. Applicant’s respectfully request that this rejection to dependent claim 11 be reconsidered and removed.

With respect to dependent claims 12-17 and 19-21, and to claims 50-52: Applicants respectfully traverse. Claims 12-17, 19-21, and 50-52 teaches a slurry having hydroxylamine, a salt of hydroxylamine, or both. The “laundry list” of oxidizers that Streinz in column 3, line 59

to column 4, line 4, says can be used was reproduced above. Hydroxylamine and hydroxylamine salts are conspicuously absent from this list. Applicants believe the Examiner is confusing Streinz's "ammonium salts, quaternary ammonium salts, phosphonium salts, or other cationic salts of peroxides" with hydroxylamine or hydroxylamine salts.

Applicants specification describes using ammonium hydroxide in CMP slurries, but it is a complexer, not an oxidizer. *See* the specification, page 5, second full paragraph. Applicants also polished copper with a ammonium hydroxide solution, a hydroxylamine solution, and a hydroxylamine nitrate solution, noting that if air or oxygen is added to the ammonium hydroxide slurry then copper etching rates can be measurable. *See* the specification, page 11, third and fourth full paragraphs. Ammonium salts are useful for polishing the oxide (oxide polishing, as opposed to metal polishing) as is taught in the instant specification, page 14, fourth full paragraph. However, this does not make ammonium hydroxide an oxidant.

Indeed, as taught by the specification on page 17, Example 2, if a strong oxidizer such as ammonium persulfate is present, ammonium hydroxide can not be added to adjust pH, as it will eventually be oxidized to nitrogen and water.

The claims at issue recite hydroxylamine, however, and not ammonium hydroxide. Hydroxylamine, NH_2OH , "decomposes rapidly at room temperature, violently when heated, and detonates in flame-heated test tube. *See* Hawley's Condensed Chemical Dictionary, Twelfth Edition, page 622, attached herewith for the Examiner's convenience. Ammonia, NH_3 , can autoignite at 1204 degrees F, and is a moderate fire risk with explosive limits in air of 16 to 25%. *See* Hawley's Condensed Chemical Dictionary, Twelfth Edition, page 62, attached herewith for the Examiner's convenience. Hydroxylamines are known reducing agents, and applicants found that at certain pH ranges hydroxylamine acts as an oxidizer. Ammonia, ammonia salts, and quaternary ammonium salts do not have any oxidizing capacity. Streinz does not mention any hydroxylamines, much less the particular combinations recited in dependent claims 12 and 17. Applicant's respectfully request that this rejection to dependent claims 12-17, 19-21, and 50-52 be reconsidered and removed.

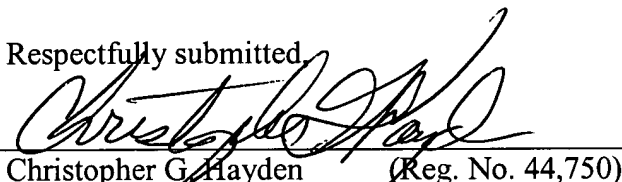
Indeed, the Applicants believe this disclosure was the first disclosure of hydroxylamine used in a CMP slurry. The Examiner is invited to review the file of U.S. Patent 6,635,186 which issued on October 21, 2003, having a common specification as the instant application.

Claims 15-18, 20 and 50-52 are rejected under 35 U.S.C. 103(a) as unpatentable over Streinz, with claims 15-18 and 20 being also rejected as being *prima facie* obvious, the Examiner citing several court rulings regarding this matter. Streinz teaches that the concentration of oxidizers is 0.5% to 15%, preferably 1% to 7% (*see* Streinz, column 4, lines 8-13). The recited claims teach concentrations that are 0.36% or less, though this is the concentration of one of the oxidizers, and the concentration of the other oxidizer required by the claim is not recited. While the Examiner's description of *In re Woodruff* is on point, as Streinz does not disclose hydroxylamine, the claims are patentable over the recited art.

There are no fees believed due in this matter; however, should any fees or credits be deemed necessary, the Examiner is authorized to charge Morgan, Lewis & Bockius LLP Deposit Account No. 50-0310.

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Respectfully submitted,



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